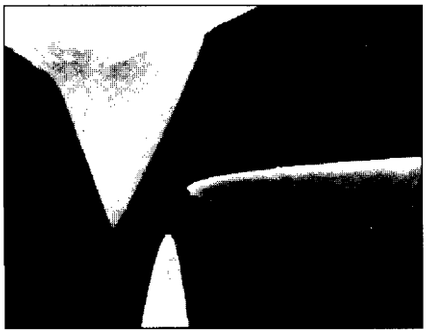

Nanojig. Robotic tips bend, stretch, and prod carbon nanotube.

says physicist and team leader Rodney Ruoff of Washington University.

Ruoff says it's too early to tell how much force it takes to break a single nanotube because the resolution of their SEM is insufficient to judge whether they are looking at a single nanotube or several. The team is hoping to answer that question using a more sensitive SEM or a higher resolution transmission electron microscope. After that, Ruoff says they plan to try welding nanotubes to each other, and then the real construction will begin. –ROBERT F. SERVICE

Looking South to the Early Universe

A flash of news from the Hubble Space Telescope: The distant universe looks about the same in two opposite directions. When the Hubble was aimed at a small patch of northern sky for 10 days in 1995, astronomers believed that their time exposure had captured a typical sliver of the distant universe. But it never hurts to check. At the beginning of October, they followed up on the original Hubble Deep Field (HDF) with a 10-day exposure of a nondescript patch of sky near the south pole—and found similar swarms of faint galaxies, some of them among the most distant and earliest ever seen.

That outcome may sound prosaic, but it's very welcome news to astronomers. "It was crucial to check on our assumption that the HDF is typical of the universe" with a second line of sight, says Alex Filippenko, a galaxy expert at the University of California, Berkeley. And the new view is more than just a reprise of the first: Instruments installed on the orbiting telescope since 1995 have enabled it to harvest far more detail this time around.

"We should call the new results not the Deep Field South but the Southern Fields," says Robert Williams, former director of the Space Telescope Science Institute in Baltimore and now a staff astronomer there, who devoted much of his "director's discretionary time" to the northern and southern deep fields. "This time we obtained three separate images, and comparisons among them will yield significant new results" about how galaxies formed and evolved.

One of the southern images was made with the same camera system used in 1995. Equipped with color filters, it recorded the galaxies' colors, which hold clues to their distances. The reddest galaxies, their light "redshifted" to longer wavelengths by the expansion of the universe, are likely to be the most distant. A second field, slightly offset from the first because it was made with a different instrument, the NICMOS infrared camera, may have captured even more distant galaxies, their light stretched all the way into the infrared. And a third field, recorded with the Space Telescope Imaging Spectrometer (STIS), broke light from the early universe into spectra that may yield new details about galaxy formation.

The HDF and the Southern Fields both record cosmic history, because they offer not a snapshot but a palimpsest of cosmic epochs, seen one behind another out to the most distant galaxy. Already, astronomers studying the HDF have traced how galaxy shapes and numbers change over time. "Look at the [most distant] galaxies: There's not a normal-looking one among them" in comparison with nearby galaxies, seen after 12 billion to 14 billion years of cosmic evolution, says Harry Ferguson, an associate astronomer at the Space Telescope Science Institute.

The STIS image in the new Southern Fields could flesh out this picture by showing how clouds of intergalactic gas fed galaxy formation long ago.

CREDITS: (TOP) ZYVEX LLC; (BOTTOM) R. WILLIAMS/STSCI/THE HUBBLE DEEP FIELD-SOUTH TEAM/NASA

Déjà vu, almost. The clutter of galaxies, up to 12 billion light-years away, in Deep Field South resembles the northern view.

SCIENCESCOPE

REPORT ON R&D STRAINS COULD STRESS ACADEMIA

The White House is finishing a report defining its relationship with the research community. But the document, a 2-year effort in response to concerns that those ties are fraying, may disappoint academic administrators seeking relief from a handful of regulations they say drain their schools' time and wallets.

White House sources say the interagency report, expected out in draft form in January, concludes that the relationship is strong but in need of attention. It reaffirms the importance of peer review and of both teaching and research in training students and asks agencies to set uniform policies on scientific misconduct. But it ducks such contentious issues for universities as the tax status of graduate students and recommends further study of how to simplify federal accounting practices and whether to remove limits to recovering the full cost of administering federally funded research.

Milton Goldberg, head of the Council on Government Relations, which last year funneled complaints from university administrators to the panel, says he's glad the report upholds the value of the government's investment in research. But he warns that individual federal agencies need clearer guidelines to avoid "subverting" such principles when they set policies for specific programs.

EUROPEAN UNION AGREES ON R&D BUDGET

The European Union's R&D program finally got a budget last week. After lengthy negotiations, a council of research ministers and the European parliament agreed to spend $18 billion over the next 4 years on the 5th Framework research plan, which supports projects jointly funded by the 15 EU nations.

The sum was less than parliamentarians had pushed for, but it was still the first real increase the program has seen since 1990. But only next year's $3.7 billion outlay is definite, because Spain pushed through a "guillotine" clause. It allows Spanish officials to renegotiate spending if they conclude next year that some regions aren't getting a fair share of the EU's full 2000-2002.

Parliamentarians are grumbling about the uncertainty. But members of the Framework's commission are "rather pleased with the outcome" because the program can begin without delay, says a spokesperson.

Contributors: Jennifer Couzin, David Malakoff, Jeffrey Mervis, and Judith Redfern

Williams and his associates hit on the idea of studying gas clouds by centering the STIS image on a quasar—a young galaxy with a brilliant beacon at its center—about 10 billion light-years from Earth, located on the sky about 0.1 degree from the basic deep-field image. As it observed the quasar's spectrum, STIS recorded dips in the amount of light produced by absorbing clouds of gas that lie along the line of sight. The redshifts of these absorption lines enable astronomers to map the distribution of intergalactic gas all the way out to the quasar. Although the lines of sight to the quasar and the southern deep field are not identical, they are close enough for astronomers to assume that the distribution of intergalactic matter is similar.

Astronomers have long sought to explain how galaxies formed from such clouds of gas when the universe was only a few billion years old. Once observers measure the exact redshifts of the Southern Fields galaxies from ground-based telescopes in Chile, "we'll be looking for correlations between the [galaxies' and clouds'] redshifts," says Williams. "This is going to provide an extremely important way to test our ideas of how the intergalactic medium turned into galaxies." **–DONALD GOLDSMITH**

Donald Goldsmith's most recent publication is *The Ultimate Planets Book* (Quality Paperback Book Club/Byron Preiss, 1998).

PATENT LAW

High Court to Review Standard for Appeal

How expert is the patent office? In a surprising move, the U.S. Supreme Court has agreed to rule on a tug-of-war over patent law that is being watched closely by computer and biomedical inventors and investors. Its decision, expected sometime next year, could limit the ability of inventors to appeal if the government rejects their patent application.

The case, *Lehman* v. *Zurko*, pits the U.S. Patent and Trademark Office (PTO) against a special federal court that hears appeals from inventors who have had their applications denied. PTO officials believe that judges for the U.S. Court of Appeals for the Federal Circuit, which hears cases ranging from patent challenges to government contract and employment disputes, have too much leeway to second-guess the government's rejections, which are often based on highly technical grounds. They would like the judges to show more respect for decisions reached by the PTO's patent examiners, many of whom hold advanced science and engineering degrees. "It's ironic that the court does not grant deference to an agency that has 400 Ph.D. scientists," says PTO Commissioner Bruce Lehman.

Lehman wants the appeals court to tell his agency to reconsider a patent rejection only if it finds the PTO acted in an "arbitrary and capricious" manner. Currently, the appellate judges can order a reconsideration if the agency was, in the court's opinion, "clearly in error" in interpreting the facts in the case.

The patent office argues that it deserves the less intrusive standard under a 1946 law, the Administrative Procedure Act (APA), which was designed to impose uniform judicial review standards on all federal agencies. But the 11-judge appeals panel, which includes several members with scientific training, has rebuffed the patent office's efforts to rein in its oversight powers. Its position is backed by many patent attorneys and business executives, who say that changing the rules could disrupt the patent appeals process and discourage research investments. The PTO hasn't "presented a compelling reason for turning a consistent system of appeals on its head," charges the Biotechnology Industry Organization in Washington, D.C., which represents about 750 companies and research institutions and has lined up with the appeals court.

The controversy stems from a 1990 patent application for a software program from computer scientist Mary Ellen Zurko, now with Iris Associates in Westford, Massachusetts, and eight colleagues then working for the Digital Equipment Corporation (DEC). The software is intended to protect transactions between secured and unsecured computer networks. In 1994 one of the agency's 2500 examiners decided that the code was too "obviously" a variation on earlier inventions to merit legal protection. In 1995 the PTO's internal Board of Appeals upheld the denial, which DEC then took to federal court.

ILLUSTRATION: TERRY E. SMITH

Two years later a three-judge panel found that the factual basis for the denial was "clearly in error" and ordered the agency to reconsider the application. In a footnote to its decision, however, the court invited the PTO to request a rehearing of the case before the full appellate panel in hope of settling the standard-of-review conflict. Last May the full 11-member panel unanimously upheld the initial ruling, finding that Congress never intended the APA to limit the court's oversight authority. "Courts do not set aside long-standing practices absent a substantial reason," it concluded, noting that adopting a more deferential standard might make the PTO's patent denials "virtually unreviewable."

Such a unanimous decision normally dooms an appeal to the Supreme Court. But earlier this month the justices accepted the PTO's plea for one more hearing on the matter. The petition complained that the appeals court had "aggrandized" its role in the patent process. It also implied that the judges don't have the technical savvy to review many patent decisions. "There was not a single judge on the [panel] who had technical expertise in the field involved" in the Zurko case, notes Nancy Linck, until recently the PTO's top attorney and now an executive at Guilford Pharmaceuticals in Baltimore, Maryland.

Such arguments are "interesting but irrelevant," says Ernest Gellhorn, who will present oral arguments this winter for Zurko and Compaq, the Houston-based company that recently purchased DEC. The key issue, says Gellhorn, a law professor at George Mason University in Fairfax, Virginia, is whether the APA allows the judges to go beyond the law's "arbitrary and capricious" standard in reviewing patent decisions. In his view, it does. Attorneys familiar with the case expect Antonin Scalia and Stephen Breyer, who have written extensively on the APA, to be influential in the decision.

Any ruling that changes the appeals process is likely to affect just a handful of cases directly. Although patent examiners reject over half of the more than 200,000 patent applications submitted each year, fewer than 100 denials end up in the appeals court. Still, patent attorneys say, those few cases can have a disproportionate influence on patent law. That's why, says the biotechnology association, inventors and investors have taken "a special interest in this issue." **–DAVID MALAKOFF**